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# Evaluating Cause and effect in User Experience

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**Abstract.** This paper describes issues in evaluating emotional and affective aspects of interaction. In particular it considers the relationship between experience factors and instrumental goals. The role of qualitative interaction factors varies from system to system, dependent on overall system goals and values, both for user and designer. Defining this role helps us to understand what is significant about emotional experience within interaction, in the context of user and organizational values. The utility and limitations of a range of evaluation methods is considered in relation to issues of tacitness, first-person experience and its relationship both to attitude formation and overt behaviour. In doing so it addresses key questions about the nature of enquiry in user-experience evaluation where experience factors are bound up with instrumental goals. The implications for technique selection and evaluation strategy are then discussed.

**Keywords.** Emotion, evaluation, tacitness, phenotype, genotype, methods

## 1 Introduction

The relatively new field of user experience (UX) evaluation has seen a number of techniques recruited in an attempt to usefully characterise affective interaction phenomena. Some of these redeploy techniques familiar from usability evaluation and other knowledge acquisition activities. Other techniques are based on previous ones with modifications that either target known weaknesses of those (e.g. MacFarlane et al 2005) or adjust them for the collection of experience data rather than knowledge or performance data (e.g. Hassenzahl and Wessler 2000). The growing interest in affective evaluation has also led to a greater interest in the use of devices such as eye-trackers and sensors for monitoring galvanic skin responses. The assumed aim of user experience evaluation is to support the iterative development of systems by giving designers and other stakeholders meaningful insights into the nature and significance of affective factors in interaction. In particular this paper focuses on designs where the goals of the system are essentially instrumental, such as e-commerce. One of the arguments of this paper is that understanding user experience and its significance is inextricably linked to the role of affective elements relative to the purpose and goals of the system. In other words, the mission of user-experience evaluation for such systems may be seen as gauging the affective response of the user, explaining that response, pinpointing relevant design features and contextualizing this within the purpose and nature of the system.

As with more established usability evaluation exercises, the design of UX evaluation within the design process requires careful analysis of the insight being sought and the questions to be answered. An informed choice of evaluation techniques involves not

only a clear understanding of the required knowledge yield but also a clear understanding of what the available techniques offer.

Emotional responses and the experience of use may be motivation for using the system, for example in a game or entertainment system. In other examples they are intimately bound up with more instrumental system goals, user values and organizational values. For example the goal may be to produce a set of behaviours, and this is a goal that is shared with the user (e.g. persuasive technologies such as diet assistants). In other cases the qualitative experience of interaction is linked to instrumental goals (e.g. forming a strong trust relationship in e-banking). In such cases, emotional responses, their stimulation and consequent effects are a critical component of interaction and in turn key design and evaluation phenomena.

Games and entertainment applications could be seen as having the goal of a good user experience, of positive felt states. Therefore the experience is the key goal, and any notion of the instrumental is subsumed within the affective. By contrast a diet mentor is a persuasive technology (Fogg 2003). Part of the system's role is simply information provision, but its presence, its ability to affect the mental state of its user, persuading them to keep their discipline and providing encouragement in this, is central to its value.

In the case of e-banking the goals and values of participants are separate but linked, and issues of user experience have a subsumed, instrumental role in it. The aim of the organization is to establish and maintain a trading relationship with the customer. In order to do this they need to establish and maintain a trust relationship with potential clients. Previous work (French and Springett 2005, French, Liu and Springett 2007) demonstrates that tangible as well as intangible factors affect the users perception of whether or not an organization is worthy of trust. Interaction may give users a sense of confidence, or a sense of unease, suspicion or resentment that they can report. The reasons for that suspicion could in some cases be satisfactorily explained by tangible factors, and directly articulated. However, the affective intangible dimension is not so easily evaluated in terms of causal relationships between the affective interface and the user's mental state.

The following sections consider some general issues in the identification and use of methods to evaluate causality and UX. Consideration of the key objectives and phenomena of interest is used to analyze the nature, utility and limitations of methods available. We also consider how UX phenomena differ from the phenomena of interest in areas such as requirements gathering and usability evaluation, and the implications for evaluation approach and method choice.

Formative evaluation requires a deep understanding of causality to be effective. Designers need to be able to pinpoint minutiae in the design of a complex interface, and points on the user's journey related to those interface particulars. Experience differs critically from more traditional usability in that it is something that in itself is not observable. The mission of 'knowing the user' is similar, but the qualitative event of experience exists outside the world. Wright and McCarthy (2008) describe the need for empathy in experience design. Empathy in interpretation of behaviour and attitudes in UX evaluation is critical for two reasons. First is simply the fact that the

direct user experience is outside the world and not available to the third person. The other is the complex relationship between pre-interaction states, interaction events, emotional events, reactions to emotional events and attitudes.

A key distinction is that between capturing an event and explaining an event. The detection of an event amounts to pinpointing a 'phenotype' (Hollnagel 1998). A phenotype is an event, an outcome its characteristics, but not a causal explanation. The journey from a phenotype to a genotype or causal explanation is critical to informing design. The non-verbal nature of first-person experience implies that an as-it-happens detection of an event is in itself devoid of any explanatory power or detectable causality. A further issue is that there seems to be a significant distinction between an emotional response and an emotional state. Emotional responses to a specific stimulus have a 'disinterested' immediacy. For example a sudden shocking change in volume, a jolt, a splash of colour can produce responses that are not in the first instance conditioned by personality or cultural attitudes (Wright et al 2003). Techniques that track galvanic skin responses are likely to be able to pair cause and response where this pre-conscious reaction occurs. Where such responses are detected and there is no sudden pairing the explanation for the change is more likely to be a state which is situated within a web of experience, of culture, of reflection. Whilst it may be relatively simple to pair a transient emotional response with a specific stimulus, it is more difficult to pair an emotional state with its cause. Extend this further, and there is a link between the event, more longitudinal attitude formation, the relationship between user and product and the relationship between user and organization.

## 2 Tacitness and the User Experience

Much of what is interesting to us in analyzing UX is tacit in nature. Thus understanding cause and effect is problematic for evaluators. The most simple, traditional notion of tacitness conceives it as knowing that cannot be made explicit through verbalisation. In Polyani's words (Polyani 1983) 'we know more than we can tell'. Polyani cites examples such as face recognition and bicycle riding where sophisticated ability to perform contrasts with a marked inability to explain. We have natural aptitude for these things that seems to be beyond our conscious understanding. Polyani's assertion is that knowledge is different from knowing, knowing being more a process than a state. Humans do not track the causality of their mental states. First-person attempts to describe and account causally for emotional events are inevitably flawed and unreliable.

It can be argued that the essence of qualitative experience, of meaning-making, of emotional engagement during interaction is in the tacit dimension. Therefore, simply to characterize the mission of evaluation as attempting to 'make the tacit explicit' is a flawed notion. Perhaps explicit descriptions of the tacit are doomed to misrepresenting it? Or rather than adopt this pessimistic position we can perhaps just simply accept that the role of evaluation instruments for UX is not exactly to capture the experience itself but to capture causal relationships in which we come to understand what

caused a change in the user's emotional state, and what in turn that change has caused in terms of, for example, attitude, perceptions of the system of the organization behind the system or the users' perceptions of themselves.

Let us consider the issue of studying and analyzing users' first-person qualitative states or 'qualia'. Qualia are broadly referred to as a private first-person experience, and essentially unique. So in this sense one can use descriptor terms reporting a felt state, but it is not possible to confirm that your experience is the same as the experience that others are having. Jackson describes this as "...certain features of the bodily sensations especially, but also of certain perceptual experiences, which no amount of purely physical information includes" (Polyani 1983). The description and the state in this sense have no point of intersection. This suggests therefore that the experience itself is not available to evaluation. If we accept this it has two possible implications. One is that evaluation instruments should not so much be trying to understand the experience itself but rather the causality surrounding it. The other is that perhaps we do want to capture the first-person experience itself, but the quasi-scientific 'hunting down' towards a 'proof' is a flawed mission and that a different philosophy is required.

It could be argued that a 'qualia event' must involve conscious awareness (Springett 2008). For it to be experienced the subject must be aware of it. This raises the question of whether qualia are necessarily what we are referring to when we consider affective aspects of system use. If we are held to the claim that qualia must be experienced, and experienced knowingly, then qualia are non-tacit and available to self-reporting. But expressions of qualia do not explain key cause-and-effect phenomena that are critical to evaluating user-experience. In a concurrent protocol session we can ask a subject about their current feelings. The subject can tell us this but not so reliably tell us why. The subject reports awareness of a qualitative state, but the causal reasoning offered has an inference gap. In some cases (and in service of some evaluation objectives) the inference gap will be trivial. A game player may express elation or joy at the point where they are observed achieving a target. The reaction and the interactive event are easy to connect causally in this example. A sense of unease during an e-commerce encounter is rather harder to fathom. This may be a burgeoning sense caused by cumulative factors, with perhaps even something from prior to actual interaction assuming significance. If, for example, the user has prior brand image some seemingly (to the designer) unrelated system behaviour or the use of language at a particular point may cause negative re-enforcement of those expectations.

A further point is that there is a difference between what we can call an emotional event (an immediate reaction to stimuli) and an emotional state (or state-change) or an emotional disposition. An emotional event might be, for example, a reaction to a sudden loud noise or a striking image. In the affective instant this is attention grabbing and may cause an immediate visceral effect. In itself it may not take so much explaining in terms of cause and effect. However, if we are interested in emotional states, attitudes and the wider affective role of systems we are dealing with something much more complex. A state-change is more longitudinal with the role of the stimuli defined within attitudes, cultural settings, value systems and goals. These changes may (as in the case of unease using e-banking) have more than one affective tributary

from the design itself. The process by which they influence the user is better seen as tacit rather than a conscious first-person experience.

### 3 Tacitness, Explicitness and Empathy

Issues of practice related to eliciting the tacit have been addressed notably in the requirements engineering literature. In an analysis of contemporary requirements elicitation approaches Maiden and Rugg identify three categories (Maiden and Rugg 1996). These are non-tacit (explicit), semi-tacit and tacit. Semi-tacit refers to knowledge that cannot be gained through direct approaches, by simply asking, but may be available to indirect probes. Without providing an exhaustive analysis, it is useful to consider this schema in relation to established and potential approaches to measuring and assessing emotional responses. Looked at in this light galvanic skin responses and any possible physiological measurement probe tacit factors. In common with observation techniques in HCI these approaches have the limitation that they catch an event, an outcome of a causal process, but they cannot in themselves provide explanation of that process.

Semi-tacit approaches in Maiden and Rugg's analysis include approaches to structured interviewing such as card sorting, repertory grids and Laddering. Laddering is used in knowledge acquisition (Rugg and McGeorge 1995) but may also be used to get retrospective judgments after encounters with a product (Desmet et al 2001). Card sorting has been used to probe amongst other things, affective reactions to visual designs, to distinguish rational and affective elements of trust formation (French et al 2007). Repertory Grids have been used to probe perceptions of alternative designs and products (Hassenzahl and Wessler 2000).

A number of tools have been tried thus far to assess affective factors in interaction. Product reaction cards (Benedek and Miner 2002) prompt users to identify 'attributes' present in a product, some of which are user experience attributes, pairing their emotional responses with a subset of preset terms. A questionnaire-based approach described by (Hassenzahl 2004) invites the user to express affective responses to products by rating them by various criteria on bi-polar scales (e.g. interesting—boring).

The advantage of these approaches is that they elicit attitudes in a bottom-up way. Direct questioning tends to get general statements of user attitudes and reactions but without efficiently unpacking them for causality. The use of semi-tacit methods allows probing to causality. We are able to gather evidence to help us reason about why the subject has formed an attitude to a product. This gets closer therefore to tracing elements of the design that have caused an affective response in the user, as well as characterizing that response.

The semi-tacit methods described above have the disadvantage that they are retrospectively applied to interaction with products or experiences with significant duration. This is with the exception of the card sort that can be used with storyboard images (thus losing the advantage of an authentic dynamic experience with the product).

Think aloud protocols, intervention techniques and the concurrent elicitation of reactions using emoticons best fit in the semi-tacit category. However, that they are concurrent not retrospective bring the expression of an emotional state closer to the affective event. The immediacy of intonation, exclamation, skin reaction, or whatever has this key advantage. Nonetheless, like the linguistic forms used in other approaches there remain a translation from a first-person state to an in-the-world expression. Further complexity is added by the fact that we, in many cases, are not simply chasing an emotional reaction, but an intellectual reaction, an affected attitude, a change in how they see themselves in relation to an organization.

The classifications from Maiden and Rugg has some value in helping us understand the way in which methods work, and the agenda of placing affective responses in context. However, having borrowed from requirements engineering research it should be clear that 'making the tacit explicit' is not so much the mission of UX evaluation as 'understanding the tacit', perhaps in contrast to requirements engineering. We are not seeking explicit matters of fact but to understand the relationship between the artefact, the user's internal physiological and intellectual state, and the context and value systems within which the encounter is situated. These phenomena are in the tacit dimension but in some sense available in-the-world. Experience sampling in UX evaluation intends to yield a rich insight into a separate-from-the-world experience, by synthesizing available in-the-world representations with their own separate-from-the-world states. To a significant extent this works in an affective way, as the interpreter of the data tries to empathetically interpret expressions or indicators of the subject's internal state, and reasons about its implications.

The experience itself is often a tributary issue and its significance in attitude forming or behaviour is what is ultimately sought in evaluation. Therefore a full useful insight must not only get a sense of the user's experience at the point of stimulation but understand its relevance in a wider context.

## 4 Evaluating emotions in Context

Probes of user emotional responses in formative support of design should have the goal of understanding cause and effect. A qualitative reaction in the user may be effected by a good design. Equally the design goal may be to produce a particular response in terms of behavior and attitude, with qualitative experience playing a pivotal role. Therefore understanding causality is a crucial goal. This suggests that direct approaches where subjects retrospectively explain their responses may be limited in value. The direct reporting of experience is straightforward enough, but an insight into causes and consequences linked to that experience may require other sources. The role of technologies that assess affective states in evaluation strategies is as yet unclear, but it is clear their use has limitations. It is unlikely that physiological responses can be reliably paired with aspects of the design in a way that explains cause and effect in depth. That an emotional response has occurred simply denotes

an issue. This suggests the need for research method triangulation as defined by Wilson (2006). This refers to the use of multiple empirical methods to build a portfolio of persuasive evaluation evidence. So approaches such as observation, galvanic skin response measures and self-reporting can denote issues, or phenotypes. More probing approaches such as repertory grids can be used in tandem to further understand and reason about the denoted design issues.

Much recent work in Human-Computer interaction seeks to place design and interaction phenomena in the context of human values (e.g. Cockton 2005). This covers organizational values and aims, those of individual organization players and stakeholders and end users. This considers the juxtaposition of usability (cognitive and physical ergonomics, fitness for purpose) system utility, subject user values, economic and ideological objectives.

The efficacy and utility of an evaluation instrument or a suite of evaluation instruments is conditioned by the ends that the affective element serves in relation to these values. Understanding the role of affective factors in the use/experience of a system allows us to properly frame the evaluation question. This role must be understood in relation to both user values and organizational values.

## **5 Two Examples: E-Banking and E-Mentoring**

Banking provides a useful example of experience design in support of instrumental and value-centred ends. This does not merely refer to the 'state of the art' in which web-based facilities may be the sole face of the organization or work in conjunction with a High Street presence. It is likely that creative artistic input will be an increasing factor in commercial web design and that factors greater TV interactivity suggest that experience design is set to become richer and more arts-based. The experience of an encounter with an interactive application is part of the brand experience. Its role is to positively reinforce the brand and facilitate an enduring relationship between business and customer based on trust.

The nature of consumer trust in e-commerce is in part rational and in part affective (French et al 2005). Rational trust involves the user checking sources such as the recognised trust seals and kite marks that can be taken as sureties and guarantees protecting against corrupt and exploitative behaviour from the organisation. However this combines with affective factors in the user's decision to trade with an organisation. Recent research seems to confirm the pivotal role of affective factors in trust formation and propagation for e-commerce and other trust-dependent sites such as online sources of expert information. Studies reported in (French et al 2007), showed that factors such as style, aesthetics and the navigation model were strong influences on trust. Studies reported in (Riegelsberger et al 2005) found that media choices and combinations affected user judgements about the expertise offered on alternative sites, whilst a study of e-health sites reported in (Sillence et al 2006) found that affective factors were significant in forming user trust in, and selections of information from alternative sites.



Examples from (French et al 2007) give indicators of the relationship between organizational values, user experience and trust perceptions and the aesthetics of design. Subjects were presented with alternative banking home pages displaying a variety of styles, ranging from formal text-based presentation to graphics and picture-based approaches. Some home page images studied by subjects were reported initially as 'disturbing' or surprising, in an initial reaction to the use of graphics and pictures. Further elaboration led participants to question the integrity of the organisations as conveyed through these designs. In another example, a number of participants gave negative reactions to homepages showing cartoons. This prompted negative responses including 'unprofessional', 'inappropriate' and 'not bank-like' from subjects. There appeared to be a strong link between this type of reaction and negative trust scores elicited in the study. These examples show an affective rather than rational reaction to designs potentially having a key impact on decision-making.

Those involved in using creative artistic skill to create experiences have therefore a key role in trust building and reinforcement. The relationship is an interleaved one with the 'pleasure' of an experience requiring trust as an antecedent and in turn positively or negatively reinforcing trust. Likewise we may think of experience or trust breakdowns as key critical incident phenomena that evaluation approaches would seek to detect and characterize.

A trust threshold needs to be reached initially and is hard to re-establish after a trust 'mismatch'. The 'breakdown cycle' has similarities to breakdowns of usability. Some usability errors (e.g. hidden security features and guarantees) may be direct contributors to trust breakdowns. In a similar way a poor user experience, such as encountering an image that is disturbing, or a badly designed system message, may affect the user's sense of their relationship with the organisation. So the attribute or quality target of 'trust' has multiple tributaries that require attention in design and evaluation, in terms of the overarching goal of reinforcing a satisfactory business-to-customer relationship.

Mentoring systems are seen as 'Persuasive Technologies' (Fogg 2003). Similar to e-banking the emotional events during interaction are significant in the context of longer-term issues such as the goals that the mentor is helping its user to achieve. For example, the goal of the user in using this system may be to keep to a diet, to lose weight and become healthier. The problem addressed is that short-term urges or careless food choices cut across this longer term goal. The user wants a virtual mentor that helps them with the difficult task of resisting immediate urges and sticking to the diet. Its presence, its ability to affect the mental state of its user, persuading them to keep their discipline and providing encouragement in this, is central to its value. The desired outcome is defined, longitudinal and instrumental. The qualitative experience during use is subsumed within the instrumental goal of, say, achieving a target weight. The success of this product in achieving this seems to be in its ability to support a complex interplay of emotions, physical dispositions and critical events. Success of a dietary mentor is subject to the unfolding of events in key situations and personal factors, and factors that are often not in the user's realm of control or awareness.

The mentor system shares characteristics with e-banking sites in that their affective role is inextricably linked to long-term goals. Therefore we are not simply evaluating

the experience of interaction in some self-contained way. A useful way of understanding this is to draw a distinction between human-computer interaction and human-computer influence made by Edmonds (2008). Edmonds applies this concept to interactive art in which the internal state of the artefact alters over time in response to encounters with individual viewers. For the systems described in this section we are more concerned with longitudinal influence that interaction has on the internal state of its user. The significance of affective design elements is in these longitudinal influences, something that cannot fully be captured by methods that focus solely on interactive encounters. There needs to be, in some form, a projection beyond those encounters to consider their consequent influence.

## 6 Implications for Evaluation Design

This paper has focused in on systems in which affective factors in interaction are part of larger and more complex relationships. In other cases it may be the case that the experience itself is the point of the design, or that the creators of an artefact (such as computer art) do not prescribe the relationship between the artefact and those that experience it. However creating an experience is increasingly an intrinsic part of design across sectors, and the relationship between experience designs, qualitative reactions within use and longer term goals and values. Where we come to consider evaluation, the exercise is a matter of assessing what data collection and interpretation with each instrument available can contribute to the rich overall picture that we are seeking. The use of triangulation both between methods and within methods is critical. The concept of triangulation and the distinction between these two types is described by (Wilson 2006).

Between-methods triangulation can exploit complimentary strengths of individual techniques. The role of individual methods may be to create an investigative agenda, to pinpoint critical issues by observing the artefact-in-use, to characterize the link from stimulus through affective reaction to effect on attitude or belief, and to cross-examine the design in the light of findings. The distinction between phenotypes and genotypes described by (Hollnagel 1998) is useful for understanding the extent of and limits to utility of particular techniques for understanding UX.

Studies of artefacts in use augmented by mood samplers, skin response monitors, or verbal protocols may be good for locating phenotypes and providing investigative evidence to trace genotypes (cause and effect relations pertinent to critical incidents). Instruments such as structured elicitation (e.g. repertory grids) seem adept for understanding how an affective reaction links to attitude. More judgment based approaches to analysis can contribute by helping us reason about the user responses in a more empathetic way. Given that interpretation and ‘empathy’ are a significant part of data interpretation and critique-based approaches the use of multiple facilitators/interpreters/critics clearly has value.

How we specify the utility of a triangulated method suite of course depends on the evaluation question. Precise investigations of causality may not be quite so relevant where design and use goals are open-ended. The more pivotal the role of the affective component in the context of system purpose and values, the more complex the

evaluation question is likely to be, hence the need for multiple methods and clear selection criteria.

## References

- Benedek, J. and Miner, T.** (2002). *Measuring Desirability: New methods for evaluating desirability in a usability lab setting*, In: Proceedings of Usability Professionals Association, Orlando, July 8-12.
- Cockton, G.** (2005) A development framework for value-centred design. CHI Extended Abstracts 2005: 1292-1295
- Desmet, P.M.A. Overbeeke, C.J. and Tax, S.J.E.T.** (2001). Designing products with added emotional value: development and application of an approach for research through design, *The Design Journal* 4 pp. 32–47.
- Edmonds, E.** (2008). *Shaping Forms on the Web with a Collective Memory*: Invited Presentation at Interaction Design Centre, Middlesex University, UK, November 2008
- Fogg B.J.** (2003). *Persuasive Technology: Using Computers to Change What We Think and Do*, Morgan Kaufmann Publishers; ISBN 1-55860-643-2
- French, T. and Springett, M.** (2005) *Characterising and Understanding intangible trust factors*, in proc IDEC conference on engagability and Design, Edinburgh UK
- French, T. K. Liu, K. and Springett, M.** (2007). 'A Card-Sorting probe of E-Banking Trust Perceptions', Proceedings HCI 2007, BCS, ISBN 1-902505-94-8
- Hassenzahl, M.** , (2004) The Attrakdif Technique <http://www.attrakdiff.de>
- Hassenzahl, M. & Wessler, R.** (2000). Capturing design space from a user perspective: the Repertory Grid Technique revisited. *International Journal of Human-Computer Interaction*, 12, 441-459.
- Hollnagel, E.** (1998) *Cognitive Reliability and Error Analysis Method*. Oxford: Elsevier Science Ltd
- MacFarlane, S., Sim, G., Horton, M.** (2005). Assessing Usability and Fun in Educational Software. *IDC2005*, pp.103-109, Boulder, CO, USA
- Maiden, N.A.M., and Rugg, G.** (1996) ACRE: selecting methods for requirements acquisition, *Software Engineering Journal* 183–192.
- Polanyi, M.** (1983). *The Tacit Dimension*. First published Doubleday & Co, 1966. Reprinted Peter Smith, Gloucester, Mass
- Riegelsberger, J., Sasse, M.A., and McCarthy, J.** (2005) *Rich media, poor judgement? A Study of media effects on users' trust in expertise*. In T. McEwan, J. Gulliksen & D. Benyon [Eds.]: *People and Computers XIX - Proceedings of HCI 2005*, Springer, 267-284.
- Rugg, G. & McGeorge, P.** (1995). Laddering. *Expert Systems*, 12(4), pp. 339-346
- Sillence, E, Briggs, P. Harris, P. and Fishwick, L.,** (2006) *A framework for understanding trust factors in web-based health advice*, *International Journal of Human-Computer Studies* 64, 8, 2006, 697–713. ISSN:1071-5819.

- Springett M.** (2008) *Assessing User Experiences Within Interaction: Experience as a Qualitative State and Experience as a Causal Event*, Meaningful Measures: Valid Useful User Experience Measurement (VUUM), 5<sup>th</sup> COST294-MAUSE Open Workshop, Reykjavik, Iceland, COST press
- Wilson, C.** (2006) Triangulation: The Explicit use of Multiple Methods, Measures, and Approaches for Determining Core Issues in Product Development , In *Interactions*, November/December, ACM
- Wright, P.C., McCarthy, J.C., & Meekison, L.** (2003). Making sense of experience. In M. Blythe, A. Monk, C. Overbeeke & P.C. Wright (Eds.), *Funology: From usability to user enjoyment* (pp. 43-53). Dordrecht: Kluwer
- Wright, P.C., & McCarthy, J.C.** (2008). Empathy and experience in HCI. *Proceedings, CHI 2008: Dignity in Design*, (pp.637-646), ACM Press